FLOWS OF THE SNAKE RIVER AT LOWER GRANITE DAM RELATIVE TO NMFS' FLOW OBJECTIVES

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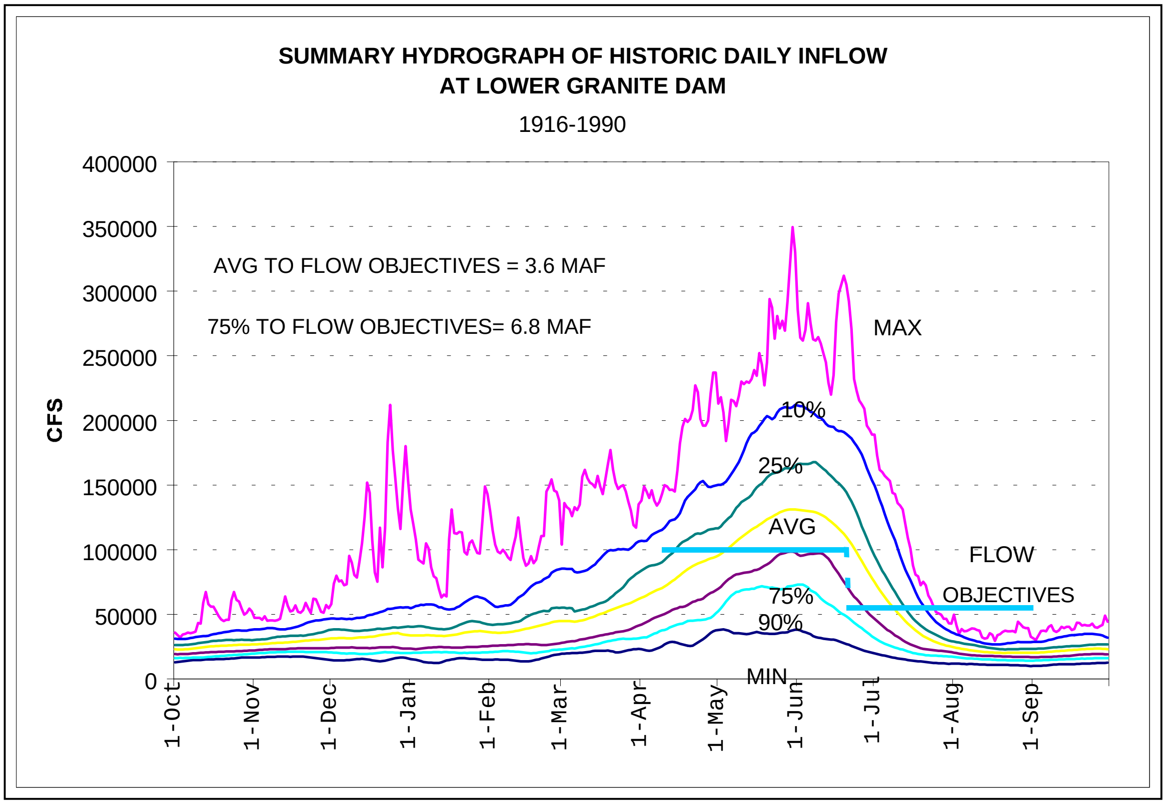
Flows of the Snake River at Lower Granite Dam were studied in relation to NMFS' flow objectives using two different data sets. Both historic daily streamflow and model-generated monthly average streamflow data were examined.

The daily data set consisted of the record for the Snake River at Clarkston (U.S.G.S. Station 13343500) for the period 1916-22 and 1929-72 and then a calculated value created by adding the Snake River at Anatone (U.S.G.S. Station 13334300) and the Clearwater River at Spalding (U.S.G.S. Station 13342500) for the period after 1972. The Clarkston gage became inundated by the Lower Granite reservoir pool in 1973 and was discontinued. The Spalding and Anatone stations represent the flows just above the Lower Granite pool and serve as an excellent proxy for the Clarkston record.

The period of record chosen for the daily historic analysis was 1916-90. Ending the period in 1990 eliminates the years in which upstream reservoirs like Brownlee and Dworshak were actively used to augment flows. Another corollary of using historic data is that changes in flow timing and quantity resulting from reservoir construction, irrigation development or other factors that have occurred over time are present in the record for varying periods of time.

A useful technique in the analysis of daily streamflow records is the summary hydrograph. The results of such an analysis consists of a family of hydrographs, each representing a maximum or minimum value, a computed average, and flows that are met or exceeded 10, 25, 50, 75 and 90 percent of the time for each day of the year. Figure 1 displays the results of a summary hydrograph analysis of the Lower Granite flow record. In addition to the hydrographs, the flow objectives for the spring period (100 kcfs) and summer period (55 kcfs) are shown on the graph. For clarity, the 50 percent exceedence flow or median was omitted from the plot since it is very close to the average line.

Figure 1

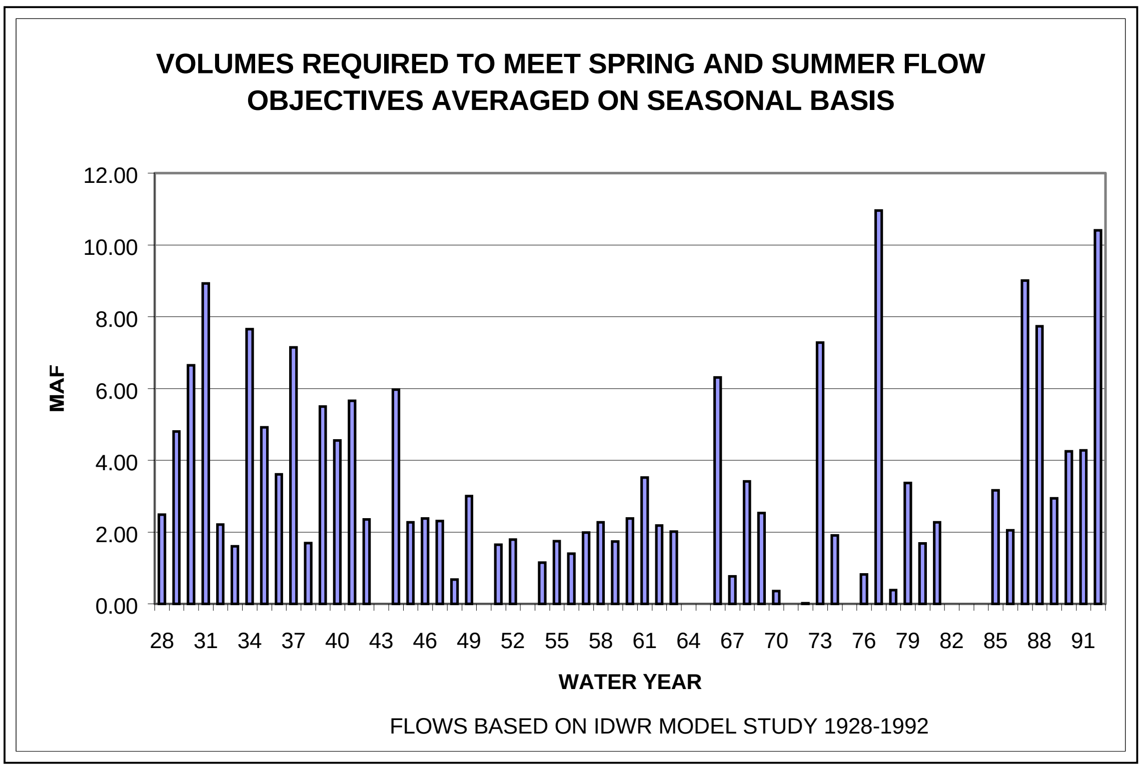


From Figure 1, it is apparent that the fixed values of the flow objectives do not follow the general hydrograph shape. Thus, the likelihood of meeting the objectives varies considerably throughout each period. At the start of the spring flow objective period (April 10), the 100 kcfs flow is greater than the 25 percent exceedence line, but by mid-to-late May the 100 kcfs objective is exceeded by the average line. Also apparent is the fact that after late July the 55 kcfs objective flow is well in excess of all the hydrographs, including the maximum of record. A computation of the volume between the average hydrograph and the flow objective lines was done by comparing each day's flow with the objective value and calculating the deficit (if any) from both the spring and summer periods. The result is that the difference between the average hydrograph and the flow objectives is 3.6 maf. The corresponding value for the 75 percent exceedence hydrograph is 6.8 maf. Computing the deficit in this manner does not count any "credit" for days that the observed flow exceeds the objective flow.

A similar analysis was conducted using monthly model-generated flow data for the Snake River at Lower Granite Dam. The data were obtained from an Idaho Department of Water Resources monthly-simulation model run that was calibrated to represent river and reservoir operation conditions as they exist in the recent past, i.e., a present condition or base study. In this way, the baseline data are similar to the pre-1991 historic analysis in the preceding section. One important way the model data set differs from the historic record is that it has all reservoirs, irrigation diversions, and other hydrologic factors as they exist presently in the basin. Thus, the flows generated by the model for 1937 are those that would have occurred if the present day river system were to experience a repeat of the 1937 water supply. The period for which the model-generated data are available is 1928-92.

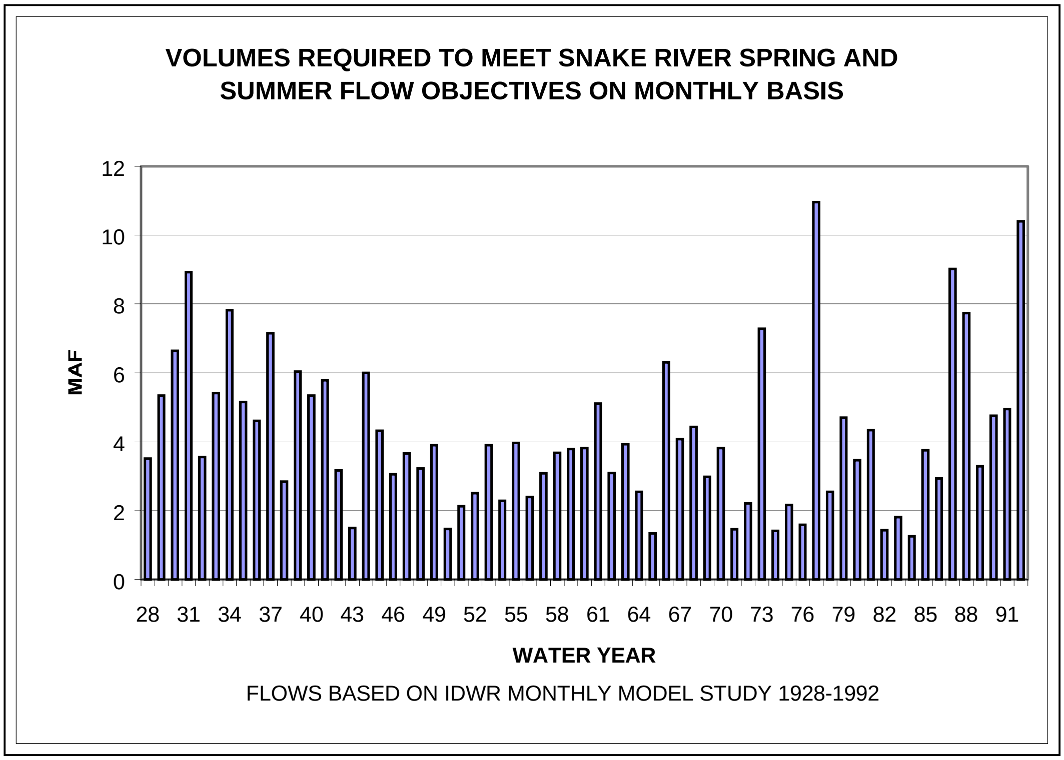
Using the monthly model data set, volumes required to meet the flow objectives were computed two different ways. The first method used the seasonal average basis of calculation. This consisted of calculating a weighted average flow from the model data for each flow objective period and comparing it with the appropriate value and then totaling the deficit, if any, for the two periods. This method is much less stringent than the one used in the analysis of the historic daily data because as long as the flow (averaged over the period) exceeded the objective, it was considered to have been met. The results of this analysis are shown in Figure 2. It is apparent that in some of the highest runoff years the flow objectives were met on an average basis.

Figure 2



The second method of computing volumes required to meet the flow objectives used the monthly data but did not average the values over the objective periods. If the flow in a particular month was less than the objective value for that month or portion of month, the amount of the deficit was computed and included in the total for that year. Thus, months that exceeded the objective values were not allowed to count as a credit to another month that did not meet the objective as in the seasonal average method. The results of this analysis are shown in Figure 3.

Figure 3



Comparing Figures 2 and 3, one can see that the monthly average method (Figure 3) results in a shortfall each year, even in the high runoff years like 1943 and 1984. These years met the flow objectives using the seasonal average method. Also, in the years with the largest deficiencies (1977, 1992, 1934, and 1987), there is very little difference between the volumes required under either method of computation.